

Reforms of Engineering Education Programmes: Social Cognitive Career Influences of Engineering Students

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Abstract: Becoming an engineer is one of the most famous career pathways for recent postsecondary graduates all over the world. In this research, the researcher investigated and discussed the reform of engineering education programmes and how postsecondary engineering students reflect on their engineering programme in the Province of Ontario, Canada. In order to address the issues of multi-cultural and poly-ethnic background in the Canadian communities, first, the researcher reviewed a recently published article about social cognitive career making. Second, the researcher followed the steps to conduct a case study with data being collected through focus group activities of 100 first-generation Asian-Canadian postsecondary engineering students. The researcher discovered the current engineering education and career counselling materials and strategies might not perfectly match with the Asian-Canadian cultural expectations and behaviours. The study serves as a case, a discussion and a review for counsellors and engineering educators to reform and redesign their curriculum and programme planning in order to respond to the students with different ethnical backgrounds in this poly-ethnic country.

Key words: Asian-Canadian postsecondary students, career decision, career development, curriculum and development, decision-making, education reform, engineering programme, first-generation students, social cognitive career theory

INTRODUCTION

Becoming an engineer is one of the most famous career pathways for recent postsecondary graduates all over the world. In 2011, 2,196,200 adults held a postsecondary certificate, diploma or university degree in the field of science and technology, engineering and engineering technology and mathematics and computer sciences. The statistics represented 18.6% of all the fields of study at the postsecondary school levels in Canada (Statistics Canada). In fact, increasing the number of engineering, science and technology graduates and trainees is one of the priorities for all countries, states and cities for further development of economic advancements and sustainability (Muller; Paige and Lloyd). However, not all postsecondary graduates have the same characteristics. They differ in age, language, race, background, economic status, marital status, employment experience, place of birth, family background and citizenship (Westwood). Also, researchers indicated that minority students are more complex in their background

than other majority students. In the current research study with a purposive focus of the reform of engineering education, the researcher examines the key cultural issues of career decisions, behaviours and sense-making process that are specific to first-generation Asian-Canadian postsecondary students who grew up in an immigrant family, particularly for engineering postsecondary school students in Canada.

Research background: Recently, Santos (2018) published a journal article entitled career decision of recent first-generation postsecondary graduates at a metropolitan region in Canada: a social cognitive career theory approach. In that study, Santos (2018) described the career perspectives and behaviours of the first-generation Canadian youth who are currently living in the Greater Toronto Region and particularly of first-generation postsecondary graduates in Canada. Unlike, some other countries without significant numbers of immigrants, Canada has a poly-ethnicity wherein international residents can spend their lives in this

country (Chia and Graves). Due to the large array of cultural and ethnic differences, one single study may not be able to cover and explore the cultural expectations and behaviours of each ethnic and cultural group in Canada (Nolte, 2018).

Additionally, the researcher discusses the tailor-made implementation and development of career counselling and planning first introduced by researchers (Santos, 2018; Lent *et al.*, 1994). That career counselling provides guidance in terms of effective and useful directions for career counsellors and engineering educators at educational and community service settings to follow in assisting first-generation Asian-Canadian students who are enrolled in postsecondary schools and who grew up in an immigrant family. The framework emphasises the specific factors and techniques required to understand the Asian cultural expectations and family engagements. It also responds to the demands of the student's social needs because cultural and poly-ethnic factors are of essential significance within the Canadian community, particularly for families with engineering students (Chang, 2008).

The researcher focuses on increasing and expanding the techniques, skills and sense of poly-ethnic considerations for career counsellors and engineering educators based on the study by Santos (2018), particularly for the needs for first-generation Asian-Canadian postsecondary engineering students. Canadian universities and higher education institutions provide liberal arts and vocational training for the next generation, designed to prepare them to become professional workers in various sectors of the society. However, findings indicated (Santos, 2018), a large number of postsecondary graduates tended to work in professional fields that do not match their postsecondary majors and chosen subjects. In addition, there was an obvious trend that students with an Asian background, regardless of their residential status, tended to enrol in the vocation-oriented studies (e.g., engineering programmes) instead of the traditional liberal arts degree programmes (e.g., the humanities). Although, individuals are allowed to select their postsecondary schools based on their own interests and decisions, this study explores how cultural expectations can influence the career decisions and the sense-making process of first-generation Asian-Canadian postsecondary students, particularly for engineering students (Liu, 2016; Samuel and Burney, 2003).

MATERIALS AND METHODS

Social cognitive career expectation of engineering students: Research by Santos (2018) identified three

themes in the study on career decisions by interviewing five first-generation postsecondary graduates in the Greater Toronto Region in Canada. The first theme was "vicarious experiences from others with similar situations" which involves the observations and behaviours of friends, relatives and family members who share similar situations and life stories. The second theme was "outcome expectations" which involves essential elements of cultural, personal and parental expectations, separate from other external reasons. The third theme was "professional suggestions from career counsellors" which is important because the participants received professional guidance and suggestions from their engineering teachers and counsellors at schools and from community services.

Social cognitive career theory (Lent *et al.*, 1994) provides a context within which participants can explore their career interests their performance and commitment considerations and their academic and career choice options (Santos, 2018). A significant finding is that all of the Asian-Canadian postsecondary graduates in his study tended to enter vocation-oriented degree programmes (i.e., nursing, management and journalism). Unlike the others, Non-Asian Canadian participants, Asian-Canadian participants expressed their ideas about financial considerations instead of their personal interests and goal development (Santos, 2018).

The theoretical background of career decision studies traces back to Lent *et al.* (1994) and Bandura (1986) who postulated that career decisions might be highly influenced by the individual's observations, personal goals and achievements. However, other research studies have indicated that Asian-Canadian students or students from Asian countries tended to enrol in well-established universities and vocation-oriented programmes due to their financial, economic and immigration status characteristics (Chen, 2007). Another research arrived at several significant findings (Bu and McKeen, 2001). First, Chinese students tended to enrol in business programmes because of those programme's stable postgraduate employment opportunities on one hand and on the other hand the students also "appeared to have a stronger need for task simplicity and predictability which is not surprising considering the fact that Chinese culture has much greater tendency to avoid uncertainty than Canadian culture" (Chen, 2007). It is worth noting that Asian students, particularly East Asian students, tend to enrol in academic programmes that will help them avoid unforeseen situations and can ensure stable career developments and promotions. These reports echoed the research findings (Santos, 2018) which identified why Asian-Canadian postsecondary graduates tended to

select vocation-oriented programmes and pursue vocation-based careers in fields other than the liberal arts.

It is worthwhile to note that Canadian statistics do not capture resident's racial background for reasons of social equality. In the 2011 National Household Survey of Canada, the most commonly reported ethnic groups in the city of Toronto were Caucasians (50.2%), people with East Asian backgrounds (12.7%), people with South Asian backgrounds (12.3%), Southeast Asians (7.0%), West Asians (2.0%) and people with an Arab background (1.1%). In other words, people with an Asian background made up 35.1% of the total population in the city of Toronto (Anonymous, 2011). Although, Canada is a Westernised country, one should note that people with a poly-ethnic background are also a well-established population in the country. Because the cultural expectations of Asian-Canadian students and their families may differ from those of other Caucasian populations, the career counselling and development programmes for first-generation Asian-Canadian postsecondary students are particularly important in their relationship to postsecondary school enrolment services, human resource departments and government leaders.

RESULTS AND DISCUSSION

Asian-Canadians engineering student's experience: For the purpose of this research study, the researcher tends to capture the career decisions and the sense-making process of postsecondary engineering students in Canada, particularly for Asian-Canadian engineering students. Canada's Asian-Canadian population has been one of the country's most important assets throughout contemporary Canadian history (Chang, 2008).

Currently, a large number of first-generation Asian-Canadian traditional-aged students have decided to enrol in Canadian universities to further their educational opportunities, particularly in the field of engineering education. However, most of the career counselling centres and engineering educators at secondary schools and postsecondary schools have based their career development materials on Western expectations which may not be suitable for Asian-Canadian candidates who select their career pathways and postsecondary majors on the basis of cultural influences and expectations from an Eastern perspective (Santos, 2018).

In order to capture the career decisions and sense-making process of the Asian-Canadian postsecondary engineering student population in the Province of Ontario this study employed a qualitative

Table 1: Demography of participants

Enrolled engineering programme	No. of participants
Computer Engineering	15
Electrical Engineering	14
Engineering Science	10
Biomedical Engineering	10
Civil Engineering	9
Chemical Engineering	9
Mechanical Engineering	8
Mineral Engineering	8
Materials Engineering	7
Physical Engineering	6
Aerospace Engineering	2
Industrial Engineering	2

approach (Merriam, 2009) with data being collected through focus group activities of 100 first-generation Asian-Canadian engineering postsecondary students based on the application of the research study (Santos, 2018). One of the recruitment requirements was that participants must currently enrol at one of the engineering education programmes at the postsecondary level. Table 1 showed the programmes that the participants enrolled.

The data also showed a surprising phenomenon: first-generation Asian-Canadians tended to study in vocation-oriented programmes. In the extant literature, most similar studies conducted by American and Canadian researchers concluded that in general, North Americans tended to base their career decisions on their personal interests and goals. However, this study indicates that first-generation Asian-Canadian postsecondary students choose vocation-oriented programmes and tend to focus on financial considerations instead of their own personal interests and goals (Santos, 2018; Lent *et al.*, 1994). The results of this study reflect researcher report into the career trends of his Asian participants (Santos, 2018).

The participants in this study expressed three factors relating to their career decisions and postsecondary major selections during their early life. First, it is worthwhile to note that all of the participants with an East Asian background indicated filial piety and obedience to their parents (Liu, 2018) as their reasons for selecting their current career pathway and postsecondary major. In one of the focus group activities when participant #3 expressed her experience as "My parents want me to become an engineer after graduation; even if I like nursing, I was asked to select engineering as my major." After her sharing that perspective, all of the other 11 participants expressed agreement with her and stated their similar life experiences. Some participants described their position as "I have to listen to my parents as I am their child." It is worth noting that Asian-Canadian students weigh their parent's recommendations as one of the most important factors in their career decision.

Second, in this study the Asian-Canadians tended to select high-income and reputable careers. Asian people usually believe engineers and scientists are some of the most reputable occupations due to their stable financial income. The researcher marked down 379 times the word “money” was used during the focus group activities. For instance, participant #90 indicated her experience as “I can avoid university education after secondary school. But I decided to study university with a major in engineering due to the financial and money concerns.” Other participants in the same focus group activities echoed her idea about financial and money concern. Both participants #91 and 92 shared the same opinions about, “engineering and science are the key majors of making money after graduation”. Participant #55 said, “the university has liberal arts college and STEM faculties. I decided to study the engineering faculties due to the money issue”.

Third, nearly 80% of the participants expressed the need to take care of their parents after their own graduation from postsecondary schools and their parent’s retirement. Unlike, in the Western perspective, Asian-Canadian people tend to take care of their grandparents and parents after they have completed their own education (Cohen and Man, 2015; Lee *et al.*, 2017). For instance, participant #43 shared, “I am a Chinese-Canadian male, ..., although, I can skip my family members after secondary school, I still need to provide financial assistance and supports to my parents as a Chinese-Canadian kid.” It is worth to note that the cultural expectation of being a supportive child is centralised in the Chinese cultural perspective. Chinese-Canadians and Canada-born Chinese-Canadians still believe supporting the elderly are their responsibilities as sons and daughters. Because the fees and resources for caring for their elders can be costly, most of the participants expressed the desire to seek high-income occupations. For example, participant #32 told us that “engineering school is a good destination for making a good amount of money in order to support my family and my parents, ..., just for money”.

The results of this qualitative study have expanded the understanding available in the literature. Although, the researcher did not capture the participant’s family status (i.e., income-status), the results have expanded our understanding of why first-generation Asian-Canadian postsecondary students make their career decisions and choose their postsecondary majors based on their cultural expectations. In fact, this research may not offer an original contribution or solid recommendation for how to redesign the engineering education curriculum and planning and career survey and questionnaire materials.

However, the results of this study have brought attention to the need for career counsellors and engineering educators to improve their current career counselling for non-Caucasian students in order to help them to identify their career pathways.

Potential reforms for engineering programmes and materials:

The above-described study not only reveals the holistic understanding, cultural expectations and career behaviours of Asian-Canadian students, particularly of postsecondary engineering students. It also suggests that career counsellors and teachers and engineering educators reform their career counselling and engineering training materials for students with multiple backgrounds. Although, the study’s Asian-Canadian students may not be able to select their careers and postsecondary majors on the basis of their own personal interests, potential reforms for career counselling and engineering training materials could include ways to match individuals with their interests in the fields of engineering programmes, advice on encouraging them to enrol in the double major programmes and whether and how to encourage them to study a minor subject during their postsecondary schools voyage. In this regard, students, not only first-generation Asian-Canadian and Asian-Canadian enrolled postsecondary students but perhaps also many other students with different backgrounds and various difficulties may benefit from ethnically sensitive reforms and culture-oriented counselling services (Rochat and Rossier, 2016).

CONCLUSION

Although, several studies have focused on the career decisions and selections of postsecondary students, few have focused on how cultural expectations may influence the career decisions and sense-making of first-generation Asian-Canadian postsecondary engineering students. This study is intended to encourage readers, including career counsellors and engineering educators, to understand the career behaviours of their Asian-Canadian student population, particularly for engineering students. Moreover, this study tends to review the cultural expectation, social cognitive behaviours and decision-making process of Asian-Canadian postsecondary engineering students alongside with the application of the study (Santos, 2018).

IMPLICATIONS

After the completion of this study’s focus group activities with 100 first-generation Asian-Canadian and

Asian-Canadian enrolled postsecondary students, the researcher introduced reforms for counselling and engineering training materials, including background-oriented expectations that could be used by several of the community centres and counselling services in the Province of Ontario.

Although, the long-term outcomes of this reformed counselling and engineering education programme may not be realized within a short period of time, the researcher would like the readers of this study to consider the significance of cultural expectations and poly-ethnic backgrounds because Canada and other countries with similar histories may all face the same problems. Last but not least this study is meant to encourage communication and the exchange of ideas about implications for developing and improving current career counselling and engineering education services and materials. The researcher has introduced the notion of reform in the Province of Ontario. However, two limitations exist. First, would all career counsellors and engineering educators be able to understand and be willing to reform their counselling techniques? Second how might this reformed counselling programme be introduced to the areas outside of the Province of Ontario? Those issues notwithstanding, however, the current research may provide a blueprint for appropriate personnel to better understand their youth and engage in more effective human resource planning for the nation.

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